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ABSTRACT

The University of New Mexico's three-year Computer Assisted Instruction Project established one mobile and five permanent laboratories offering remedial and vocational instruction in winter, 1984-85. Each laboratory has a Degem learning system with minicomputer, teacher terminal, and 32 student terminals. A Digital PDP-11 host computer runs the TOAM operating system. Originally developed for Israel's culturally diverse immigrants in educationally isolated rural areas, the Degem system courseware was selected for its relevance to the basic skill remediation needs of rural New Mexico's multi-ethnic population. Courseware emphasizes mathematics, English as a second language, and reading through drill-and-practice and diagnostics. Introductory courseware in electricity, typing, algebra, sciences, and geometry was added. Each student receives individualized lessons at each session, based on initial placement results and subsequent performance. Instructors can print reports pinpointing a student's difficulty with course subtopics. Computer assisted instruction offers differentiation of curriculum and pace, increased ease of instructional management, and increased information flow. The mobile laboratory seems appropriate for a rural state with minimum resources, but further research is needed for successful use. Questions include scheduling for maximum use and effectiveness, best use in basic instruction or diagnostics, course adaptation to a transient schedule, and teacher reaction to a mobile system. (LFL)

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MOBILE COMPUTER-ASSISTED-INSTRUCTION IN RURAL NEW MEXICO

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THE COMPUTER-ASSISTED-INSTRUCTION PROJECT

In the winter of 1984/85, the University of New Mexico, in conjunction with the state of New Mexico and the Degem educational systems company of Tel Aviv, Israel, began the Computer Assisted Instruction Project (CAIP) of the College of Education. The CAIP was established as a three year research and development project with permanent laboratory sites at Luna Vocational Technical Institute, New Mexico State University at Grants, the University of New Mexico, Albuquerque Public Schools, and Western New Mexico University.

Each permanent site has a full Degem learning system consisting of a mini-computer, a teacher terminal, and 32 student terminals. The host computer is basically a Digital PDP-11 with a forty megabyte hard disk drive and tape-cassette backup with some modifications designed by Degem. In addition to running the well known RT-11, RSTS, and Unix operating systems found on many such systems, the Degem company, the Center for Educational Technology of Tel Aviv, and the University of Tel Aviv have developed the TOAM operating system which is used to administer, present, and develop instructional programs on the Degem computer system.

Each learning laboratory is administered by a locally-designated coordinator in charge of scheduling, registering of students, administration of student records, and report generation for the particular site. The UNM-CAIP personnel monitor student progress for all sites, train the teachers and administrators at the sites, test and disseminate new courseware, and aid the sites in developing site-specific courseware and applications as the need arises.

The courseware presented on the Degem system was orginally developed to meet both remedial and beginning vocational education needs in Israel. The initial requirement was for a well sequenced instructional support program in language and mathematics to assist with the educational needs of a large influx of culturally diverse immigrants. In particular, the program was intended to have its greatest impact in rural areas suffering from large teacher turnover and relative deprivation due to isolation. These were important factors in the adaptation and eventual installation of the program in New Mexico, as the conceptual development of the system was consistent with identified needs, i.e., multi-ethnic populations requiring basic skill remediation, often within the context of retraining and vocational preparation.

The focus of the TOAM courseware now in use is on the basics: mathematics, ESL, and reading. These programs emphasize

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drill-and-practice and diagnostics. In addition, introductory tutorial courseware in electricity and typing are available, with development proceeding in a number of areas including algebra, the sciences, and geometry.

In the basic skills programs, students are assigned access codes which provide them with entry for the duration of time that they use the programs. Recommended time on the mathematics and ESL packages is at least 2 to 3 sessions (10 minutes each) per week. Both of these programs are multi-level, comprehensive curricula. For example, the mathematics lessons are based upon 15 subtopics from basic math spanning early elementary to pre-algebra. Each student first works through a testing algorithm which will, usually within two hours of use, result in the placement of that student at a unique level of difficulty within each of the 15 subtopics. During each session thereafter, the student is presented with a completely individualized lesson based upon the initial placement results and performance since that time. With success, the level of difficulty is increased. The level is lowered if the student encounters problems with a particular topic.

At any time the instructor can print a report for a student, a class, or for all students using the system. These reports represent a critical component of the student-teacher-computer relationship which Degem is trying to foster. The reports indicate precisely where a student is having difficulty within any of the 15 subtopics within the course, thereby providing valuable feedback to the teacher. In addition, the reports based upon total student achievement offer information on a scale of value to both teacher and curriculum coordinator.

This model can be traced to the Stanford University Computer Assisted Instruction project and that project's best known researcher, Patrick Suppes.

The TOAM courseware and the operating system controlling its implementation reflect the four major aspects of CAI which, to those involved with the Stanford project, seemed to offer "the greatest potentiality for education at all levels."

1. DIFFERENTIATION OF CURRICULUM During each lesson at a terminal, a student is presented with problems from appropriate subtopics, at levels of difficulty determined by that particular student's achievement on the system up to that point in time. It is important to note that performance within a subtopic is assessed independently of

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performance in the other subtopics, and that the number and types of problems presented during a lesson reflect this assessment.

2. DIFFERENTIATION OF PACE Because computer-based instruction can offer immediate attention to the response of the student, individualized-pacing can replace external-pacing. The TOAM operating system constantly makes adjustments to student records, hence to the individual student lesson presentation, altering the level of difficulty and therefore the length of time required to complete a subtopic and the overall curriculum. With adult learners on flexible schedules, the differentiation of pace can become even more pronounced according to the individual's investment of time-on-system.

3. INCREASED EASE OF MANAGEMENT OF INSTRUCTION In the CAI environment, the correction and recording tasks can be accomplished by the computer system rather than by the instructor/teacher. As noted, the TOAM system includes a management component which, in effect, grades and places each student on a continuous basis based upon all responses. Printed reports concerning this management can be produced for a particular student, for an entire class, or for an entire school. The latter two reports include summarizing descriptive statistics.

4. INCREASED INFORMATION FLOW The use of educational computers to present information and questions in an interaction with students opens the possibility of using the very same computer to collect large amounts of information concerning the nature of the task of learning that information. It was this aspect of the technology which most interested the Stanford group: "...we emphasize that we are not merely concerned to describe the program as it operated in schools. In many ways we have concentrated even more on the contribution we hope we can make to the fundamental understanding of how children learn and how they retain arithmetic skills." The system used by the CAI Project maintains extensive records describing the types of problems and transitions which cause the greatest number of students the greatest difficulty. This information can and should be of interest to teachers, researchers, administrators, parents, and curriculum coordinators.

THE MOBILE UNIT

In addition to the fixed lab sites, the CAIP maintains a mobile CAI laboratory. This unit is a self-contained, lighted, air-conditioned

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classroom and administrator's office. It is a forty-foot long trailer which is pulled by a typical tractor-truck. Once the unit arrives at its destination, the trailer is stabilized and the sides extend forming a full-sized classroom. A complete Degem computer system with the 32 student terminals and an administrator's terminal is contained inside. All courseware and hardware are identical to that found at the permanent sites.

The CAIP has a unique CAI delivery system in the mobile laboratory. The mobile laboratory is capable of offering computer-based instruction in mathematics, English, electricity, typing and computer programming/literacy at multiple sites on a variable schedule.

As educational and financial resources continue to dwindle, the combination of a mobile classroom and computer assisted instruction seems to be an idea worth exploring. The mobile CAI concept seems most appropriate for a rural state such as New Mexico. The school districts in such a state often cover large geographical areas with a minimum of resources.

However, the concept of mobile CAI is new and relatively untested. It remains to be seen how such a tool might most effectively be employed. Research is needed in order to decide how to utilize such a laboratory successfully. In additon, further research should be carried out to determine how mobile CAI might best be used with particular populations, such as Native Americans living on reservations, or older students retraining for a changing job market.

<u>QUESTIONS INVOLVING THE MOBILE LABORATORY</u>

The UNM CAI Project intends to explore several research questions dealing with the concept of mobile, computer-based education. Some questions already posed are:

a. For what purpose is the lab most suited: basic instruction or diagnostics?

b. If the lab is to be used for instructional purposes, what is the minimum time that it can remain at a site and still be effective in improving achievement? A similar question is: If the lab is to be used for instructional purposes, how many sites can successfully be served by one mobile laboratory?

c. If the lab is to be used for diagnostics, what is the minimum time that it can remain at a site and still be of value to the instructors as a feedback tool? A similiar question is: If the lab is to be used for diagnostics, how many sites can be served by one laboratory?

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d. If the lab is used for instructional purposes, are there particular courses which are more effective given the temporary and transient nature of the lab's visit to a site?

e. How does the temporary and transient nature of the lab affect teacher reaction to CAI? In turn, how do these attitudes affect teacher training for such a mobile system?

All of these questions could be stated addressing specific student populations, such as Native Americans.